

013084

JPRS 82335

29 November 1982

China Report

SCIENCE AND TECHNOLOGY

No. 181

19990503 072

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CHINA REPORT SCIENCE AND TECHNOLOGY

No. 181

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APPLIED SCIENCES

INTERNATIONAL MEETING ON LASER MEASUREMENT OPENS IN BEIJING

OW251522 Beijing XINHUA in English 1509 GMT 25 Oct 82

[Text] Beijing, October 25 (XINHUA)--China has built up a length measurement system based on laser wavelength to serve precision processing, quality testing, and observation in scientific research. The accuracy of China's primary standard for length metrology has reached advanced world levels.

This was revealed at an international symposium which opened here today. At the symposium scientists from eight countries will discuss measuring lengths and angles with laser, computer, and other advanced techniques.

The International Symposium on Measurement of Geometric Quantities is sponsored by the Chinese Society for Measurement. Ninety-four metrologists from Japan, Britain, United States, China, and other countries are attending the 4-day symposium. The participants will contribute 42 papers.

Geometric quantities include parameters of size, form, and space distance. Measurement of geometric quantities is important for accuracy and quality of products, standardization, and scientific research.

Measurement by laser, optical grating, computer, and photo-electronic techniques has been developed since the 1960's. China has made much progress in the field, according to the symposium.

In an international comparison in Paris last June, China's value of primary standard for length metrology was very near to the average value, with an error of only 0.02 micron, or one-3,000th of a hair, which places the accuracy of China's metrology on advanced world levels.

China established its primary standards for length metrology in the 1950's and the early 1960's. In the mid-1960's, China started study of frequency stabilized laser for measurement.

CSO: 4010/18

APPLIED SCIENCES

FOSHAN SETS EXAMPLE IN TECHNOLOGICAL ADVANCE

OW302215 Beijing XINHUA in English 1244 GMT 30 Oct 82

[Text] Guangzhou, 30 Oct (XINHUA)--Foshan, a medium-sized city of light industry and textiles in Guangdong Province, has transformed or replaced 37 percent of its old equipment since 1979 with imported equipment and technology, according to provincial authorities.

It was able to do this with foreign investment absorbed in its processing and assembling business with foreign firms and through compensation trade.

This city furnishes a good example of how Chinese coastal enterprises could carry out technical transformation, the authorities said.

Between early 1979 and September of this year, the city imported about 7,000 pieces of equipment and 12 production lines through its processing and assembling business and compensation trade. The total value ran to U.S.\$14 million. During this period the sum used for imports equalled to 83 percent of the total investment made by the state for the city's industrial growth over the past 30 years.

As a result, part of the equipment in the cotton textile, knitwear, porcelain, plastics, foodstuffs and electronic industries has been renewed or upgraded. Equipment for the garment and leather industries has been completely raised.

The local authorities said the city followed the principle of making imports serve the needs of economic readjustment, technical transformation of old enterprises and improved production performance and exports. Emphasis is put on equipment for light and textile industries, that helps conserve energy and raw materials.

The city's No 1 knitwear mill imported 230 pieces of equipment worth U.S.\$286,000 to replace or renovate 70 percent of its sewing equipment and 40 percent of the weaving equipment and 60 percent of the dyeing equipment. The mill wrote off the investment in just 3 years. Profits also increased sharply.

The import of technology and equipment raised the city's industrial output value to 1,056 million yuan in 1981, an increase of 56 percent from 1978, averaging

16 percent per annum. The city's industrial output value in the first 9 months of the year reached 839 million yuan, an increase of 16 percent over the same period of last year.

Besides, the city's exports increased from 150 varieties in 1978 to 240 in 1981. The total value of export purchases rose from 98 million yuan in 1978 to 204 million yuan in 1981. In the first 9 months of this year, export purchase value came to 194 million yuan, a 26.4 percent increase over the same period of last year.

CSO: 4010/19

APPLIED SCIENCES

HIGH POLYMERS USED AS DRAG REDUCING AGENTS

Shanghai ZIRAN ZAZHI [NATURE JOURNAL] in Chinese Vol 5 No 7, Jul 82 pp 493-495, 510

[Article by Shi Guanyi [0670 6034 0001] of the Shanghai Organic Chemistry Institute of the Chinese Academy of Sciences: "High Polymers and Energy Resources"]

[Text] High polymer materials are macromolecular organic compounds synthesized artificially by chemical methods or by chemically changing the properties of natural products. They are mainly used to make plastics, rubber, fibers, paints, packaging materials and functional high polymer materials that have special properties and uses. They are widely utilized in every realm of the national economy and in every aspect of man's clothing, food, living and transportation. At present, the popularity of high polymer materials by volume of annual production has surpassed the sum of all metal products. High polymer materials are mainly synthesized from coal and petrochemical products. In this age of petroleum and energy shortage, why do we need to develop high polymer materials in a big way? To answer this question, we must naturally analyze the energy consumption of metallic, inorganic and high polymer materials, i.e., to find out whether the energy consumption in producing high polymer materials is higher or lower than other materials, and what relationship it has with energy conservation and the development and utilization of new and old energy resources? This article will describe high polymer materials as the material with the lowest energy consumption, high polymer drag reducing agents and energy conservation, high polymers and petroleum exploitation, and high polymers and new energy resources.

High Polymer Materials Consume the Least Amount of Energy

The specific gravity of high polymer materials is lower than metals, porcelains and cement. Using them to manufacture means of transportation can greatly conserve such energy resources as petroleum. At present, their strength, rigidity and durability are close, and high polymer materials with better properties than those of metals have already been manufactured. Therefore, we can use plastics to replace metal in manufacturing automobiles, airplanes and ships. Besides the engine, all-plastic automobiles have already been manufactured. It is expected that by the year 2000, every automobile will require 500 kilograms of plastics.

Although the raw material of high polymer materials is coal or petroleum, the raw material used for high polymer materials constitutes only a very small portion of the world's petroleum production. At present, petrochemical products constitute 5 percent of the world's output of petroleum. Of this 5 percent, only 1/3 is used as raw material for high polymer materials. At present, petrochemical products are changing from the present reliance on petro-olefines to carbon chemistry. Therefore, the consumption of petroleum as raw material for high polymer materials is gradually lessening. In addition, although metals, cement and glass use natural mineral deposits as raw materials, the amount of energy consumed in smelting, manufacturing and processing is much higher than that for high polymer materials. Table 1 lists the energy consumption of aluminum, steel, glass, paper and plastics. It can be seen from Table 1 that energy consumption by weight shows that plastic has a much lower consumption than other materials. Energy consumption by volume shows that because the density of plastic is lower than other materials, the energy consumption of high polymer materials is lower than that of other materials by several times. Table 2 lists the energy consumed to manufacture the same volume of bottles or containers for soft drinks. The energy consumption for manufacturing plastic bottles is the lowest. It is 20 to 30 times less than that for glass bottles and aluminum cans. Therefore, in nations using petroleum to generate electricity and as fuel, the amount of petroleum consumed to manufacture the same volume of metallic and non-metallic materials is actually much greater than that to produce plastic. In addition, waste plastic can still be used as fuel. For example, the thermal value of a waste polyethylene bottle of 2 liters in volume is 317 kilocalories. It is sufficient to boil 4 liters of water. Metallic and inorganic materials do not have any thermal value that can be utilized.

Table 1. Energy Consumption To Manufacture Various Types of Materials

<u>Materials</u>	<u>Energy consumption (kilowatt.hour/lb)</u>	<u>Materials</u>	<u>Energy consumption (kilowatt.hour/lb)</u>
Aluminum	33.6	Paper	3.2
Steel	6.3	Plastics	1.4
Glass	3.6		

Table 2. Energy Consumption To Manufacture Soft Drink Bottles or Containers of the Same Volume

<u>Container</u>	<u>Weight (ounces)</u>	<u>Energy consumption (kilowatt.hour/unit)</u>
Aluminum can	1.41	3.00
Glass bottle	8.83	2.00
Steel bottle	1.76	0.70
Paper milk carton	0.92	0.18
Plastic bottle	1.23	0.11

High Polymer Drag Reducing Agents and Energy Conservation

Today, pipes are widely used in industry to transport fluids. For example, oil pipes are used to transport petroleum. The chemical industry uses pipes to transport organic fluids and fuel. Water circulates in pipes to cool boilers. Water hoses are used to put out fires. But fluids flowing in pipes must overcome drag, therefore it must consume energy. How to conserve this energy has naturally become a problem of concern in industry.

When fluids flow inside pipes, turbulence frequently occurs. This is the main cause of drag and increased energy consumption. Adding a small amount of high polymer substance in the fluid can suppress turbulence and thus reduce the drag of the flow and greatly conserve energy. The earliest report of using high polymers to reduce drag was by Toms. He discovered in 1948 that after adding 0.25 percent of polymethyl methacrylate in chlorobenzene, the drag in the flow in pipes was 50 percent less than before it was added. About the same time, Mysels also discovered a similar phenomenon. He measured the pressure drop in the flow of aviation gasoline inside capillary tubes before and after adding aluminum soap. When the condition for turbulence was reached, the pressure drop in a unit length of pipe after adding aluminum soap was smaller than before.

After this, oil field workers discovered that guar gel extracted from plants (a kind of macromolecular polysaccharide) has a visible effect in reducing drag in water. When extracting petroleum in the oil fields, large amounts of water containing sand must be pumped into the wells to increase the pressure in the underground oil layers and break the oil-containing rocks. At first, guar gel was used as the thickening agent to suspend the sand in water. But it was discovered during the course of use that after adding 0.1 percent to guar gel, the energy of the pressure pump could be reduced 70 to 80 percent. This showed that the drag of the flowing water containing guar gel was greatly reduced. Later, polypropylene amide and such synthetic polymers were discovered and found to reduce drag in water. In 1962, Fabula also discovered that after adding polyoxyethylene in water, the drag of the fluid visibly reduced. This is the most effective high polymer drag reducing agent at present. Adding several million parts in water can produce visible results.

The effect of reducing drag in fluids by polymer drag reducing agents is related to the molecular weight, the degree of dissolution, the concentration, the diameter of the pipes and the speed of flow. But the foremost condition is that the polymer drag reducing agent must be able to be dissolved completely in the fluid, i.e., the fluid should be a good solvent of the high polymer used to produce a reduction in drag. The molecular weight of the polymer should surpass a critical value (about 100,000) before it has a drag reducing function. The higher the molecular weight, the better the effect of reducing drag and the lesser the concentration. Polyoxyethylene mentioned above has a molecular weight reaching several million and even surpasses 10 million, therefore the amount required can be as little as several million parts. Generally speaking, high polymers used as drag

reducing agents should be linearly flexible molecules of the high polymer. The drag reducing effect of any high polymer is closely related to a fluid's speed of flow. When a fluid flows slowly in a pipe, turbulence is not produced. At that time, there is no visible drag reducing function. As the speed of flow increases, turbulence is formed, and the drag reducing function begins to show itself. When the speed of flow reaches a definite value, the drag reducing effect is the best. Under the most favorable condition, 70 to 80 percent of the energy can be conserved. When the speed of flow continues to increase, this value continues unchanged. The efficiency of polymer drag reduction can be expressed as:

$$\text{Percentage of drag reduction} = \frac{\Delta P_s - \Delta P_p}{\Delta P_s} \times 100$$

where ΔP_s is the pressure drop produced by friction when the fluid flows through a unit length of pipe; ΔP_p is the pressure drop produced after a high polymer is added in the fluid when it flows through a unit length of pipe. If this value reaches 80 percent, this means the energy consumption can drop to 1/5 the original. This is a very sizable figure.

1. Several Commonly Used High Polymer Drag Reducing Agents

(1) Guar Gel. It is a natural polysaccharide consisting of mannose and galactose. It can be used as a food additive and thickening agent. When used in the petroleum industry as a suspension agent for pressurizing and cracking liquid, it was discovered that the drag of the flow of its water solution was smaller than pure water, it did not degrade under a very high shearing velocity, and its viscosity did not drop in salt water. These properties have enabled guar gel to be used widely in petroleum extraction. Sesbania gel extracted from the seeds of sesbania in our nation has a similar chemical structure as that of guar gel and it has also been widely used in the development of our nation's oil fields. Guar gel or sesbania gel that has not been denatured is difficult to dissolve in water. After carbonyl methylation, it acquires a quick dissolving property. Therefore, denatured plant gels are also frequently used in oil fields.

(2) Polyoxyethylene. Its drag reducing efficiency is the highest among all polymers, i.e., the concentration required to reduce a definite drag is lower than that of all other polymers. If one one-millionth is added in water, the drag during flow will be reduced by 20 percent. Adding 25ppm can reduce the drag by 75 percent. This high polymer has a linear structure. It can produce a drag reducing function in all its solvents such as water, benzene, carbon tetrachloride, chloroform, trichloromethane. Tests show that after adding polyoxyethylene in salt water, glucose, plasma, the blood pressure can be lowered.

(3) Polypropylene amide. Its drag reducing efficiency is between that of guar gel and polyoxyethylene, but it is more easily dissolved in water, therefore in cases where a quick dissolving property is required, this type of polymer can be used. Through partial solution in water to increase its

molecular weight or using large hydrophilic side radicals, we can increase its drag reducing performance.

(4) Other Polymers. Carbonyl methyl cellulose sodium salts, carbonyl ethyl cellulose, polystyrene sodium sulfonate, are drag reducing agents of water solutions. Polyisobutylene is the drag reducing agent of crude oil, fuel oil and cyclohexane. Polymethyl methacrylate is the drag reducing agent for such organic solvents as methylbenzene.

2. The Uses of Drag Reducing Agents

The function of drag reducing agents is to reduce the drag of a flowing fluid and realize the goal of conserving energy. It is being used more widely. The addition of polyisobutylene in petroleum transported in oil pipes can conserve energy and increase the speed of flow. At present, the problem of degradation of polyisobutylene during the course of flow is being solved. After adding polyoxyethylene in water, the output velocity of water in putting out fires can be increased fourfold. Tests show that after adding 200 ppm of polyoxyethylene in water, the pressure drop in a hose of 700 feet long can be reduced by 40 percent, therefore, when the pumping rate remains unchanged, the height of the water from the fire extinguisher can be increased 50 percent while the amount of flow can be increased 10 percent, and the water column is not easily scattered by wind. The water flow can be concentrated within a very small area and this greatly improves the efficiency of putting out fires.

Speed boats that navigate sea waters and that are equipped with spouts that spray a polyoxyethylene water solution into the surrounding water can reduce drag during navigation and increase traveling speed.

Adding polyoxyethylene in the cooling water of boilers at power plants can increase the efficiency of the boiler because of faster water flow.

High Polymers and Petroleum Extraction

Contrary to general understanding, underground petroleum does not come from oil pools. It is deposited in porous sandstone or limestone. Oil frequently coexists with gas. The pressure in the underground oil layers often reach several thousand pounds per square inch. After an oil well is drilled, the underground pressure can spew out the petroleum. In this way, 15 to 20 percent of the underground oil reserves can be extracted. To maintain a high underground pressure so that more oil can be extracted, water injection is frequently used. This is to inject sand containing water under very high pressures into the well to drive the oil from underground.

Although water is present everywhere and is cheap, and its viscosity is also close to that of oil, it is not an ideal oil driving liquid. Because water and oil cannot dissolve each other, frequently small amounts of oil from rock crevasses are driven out by water and the oil exists as small scattered drops in the water. Water does not easily penetrate rock pores that contain large

amounts of oil. Also, the viscosity of water is not large enough, and water easily flows past the rocks along the path of least drag. In this way, what is gathered after injecting water is not oil but a water and oil mixture containing large amounts of water. When the ratio of water and oil in that mixture surpasses 20:1, injecting water would have no economic value.

To produce more oil, we must block the water to drive the oil, this means, to reduce the speed of loss of water from the rocks and drive the oil out. The most effective method is to add water soluble high polymers in the water, such as partially dissolved polypropylene amide or natural polysaccharides in the water. The speed of the fluid passing the rocks and the permeability k of the fluid in the rocks is related to the viscosity η . The higher the viscosity of the fluid, the smaller the permeability, and the slower the speed it passes over the rocks. After adding less than 0.5 percent of polypropylene amide in water, the viscosity increases, the permeability decreases, and the water and oil ratio actually determined in the extracted petroleum is the active ratio of water and oil in the rocks $M = (k_{\text{water}}/\eta_{\text{water}}) / (k_{\text{oil}}/\eta_{\text{oil}})$. Before adding the polymer, M is higher than 10 to 30, i.e., the speed of water passing over the rocks is larger than that of oil by the same multiple. Therefore, what is mainly extracted is water, not oil. After adding the polymer, M can drop to 1 to 2, and compared to the pure water injection method, after adding water soluble high polymers in water, 80 percent more oil can be extracted.

There are two types of water soluble high polymers frequently used in oil field exploitation: One is a synthetic polymer represented by polypropylene amide. Its molecular weight is high and after partial dissolution in water, the molecules carry an electrical charge. It is a high polymer electrolytic substance, therefore, it has a very high viscosity in dilute solutions. Also, the partially dissolved polypropylene amide water solution is a non-Newtonian fluid, i.e., its viscosity in high shear velocity (equivalent to the situation of high pressure injected water flowing through pipes) is very small. The viscosity is about the same as that of water, therefore energy can be conserved. Under a low shear velocity (equivalent to flowing in rock crevasses), its viscosity is very large, several dozen to a hundred times larger than the viscosity of water. Therefore, it is used the most in oil wells but its shortcoming is that it is not suitable for use in salt water, especially water containing bivalent calcium and magnesium ions.

Another type is natural polysaccharides, including guar gel and sulfoids. The latter is formed by microorganic fermentation of hydrocarbons. Polysaccharides are expensive and they are easily degraded by microorganisms, but they can be added in salt water or they can still function when the oil layers contain salt water.

Because the traditional method of oil extraction (including the water injection method) can only extract one third of underground deposits of oil, therefore, at present, all oil producing nations in the world have invested a lot of money to study ways to improve the oil extraction rate. Adding water soluble polymers in injected water is only one method.

In addition, there are also methods of using carbon dioxide, surface activators and alkaline water to drive oil. The method of using carbon dioxide to drive oil is to inject carbon dioxide in place of water into the geostрата. But the viscosity of carbon dioxide is very low. To increase viscosity, we should add polymers that are soluble in carbon dioxide or make the water that contains carbon dioxide, surface activators and polymers into a foam and then drive the carbon dioxide or its foam into the geostрата. However, water containing polymers must also be injected. When using surface active oil and water mixtures and alkaline water to extract oil, a large amount of polymer-containing water must be injected after injecting the above fluids to reduce cost and to drive the above fluids into the rocks.

Therefore, all measures to improve the rate of oil extraction must use a large amount of water soluble polymers. At present, the United States uses over 10,000 tons of high polymers each year in oil extraction to improve the rate of oil extraction. It is estimated that the need will quickly reach 40,000 to 50,000 tons. In recent years, the United States has already established plans to improve the oil extraction rate in oil fields. Investment in improving the oil extraction rate using polymers has surpassed 100 million U.S. dollars.

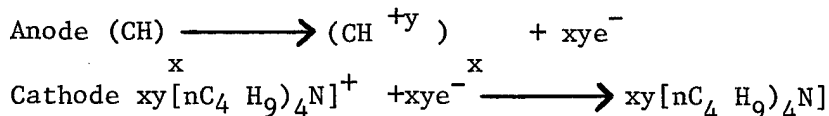
High Polymers and New Energy Resources

Chemical energy resources are of only two types: One type is the non-reproductive battery that converts chemical energy into electrical energy, or the rechargeable battery. The other is the photogenic voltage battery that converts solar energy into electrical energy.

Although not long ago, all materials related to chemical energy resources were metallic or inorganic, and organic high polymer materials were used only as outer shells or casings, but in recent years, the development of organic metals has caused a fundamental change. Since 2 to 3 years ago when polyacetylene was discovered, and since the development of organic polymers with a common valence bond that can be impregnated by chemical methods to form p-type or n-type semiconductors and organic metals, high polymers have acquired a broad future in energy applications.

The polyacetylene film is originally an electrical insulator. Its electrical conductivity is about $10^{-9} \Omega^{-1} \text{cm}^{-1}$. But when it is impregnated with a strong oxidizer or a strong reducing agent, its electrical conductivity can be increased by 12 magnitudes. After impregnating 1 mol percent of impurities, a change from semiconductor to metal occurs. When the concentration of the impurity continues to increase (1 to 10 percent), the electrical conductivity increases very slowly and under room temperature, the electrical conductivity finally reaches $10^3 \Omega^{-1} \text{cm}^{-1}$. Its density-electrical conductivity ratio (the ratio between electrical conductivity and density) is about the same as that of mercury, about 100 times smaller than that of good conducting copper. Because of this characteristic, it is possible for polyacetylene to replace metals as a material for electrodes. If we use a polyacetylene film of 0.1 mm thick as the anode and platinum as

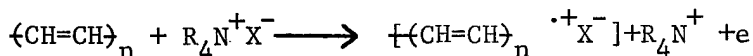
the cathode in a CH_2Cl_2 solution of such quaternary ammonium salt solutions as a KI water solution or $[(n\text{-C}_4\text{H}_9)_4\text{N}]^+(\text{ClO}_4)^-$ and pass a 9V voltage through it for 30 to 60 minutes, the polyacetylene will reach a metallic state. The electrode reactions are as follows:



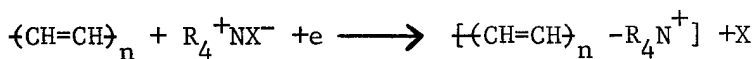
After charging, electrical discharge can cause the electrode reactions to reverse. Such a battery has a voltage of 3.7V during discharge. The short circuit current is 25mA, and only 0.5 square centimeters of polyacetylene is needed as the material for the electrode and the weight is less than 2mg. After charging and discharging 326 times, the current voltage characteristic remains unchanged. The polyacetylene film will not change.

Why does polyacetylene film used as a material for electrodes have so many advantages, such as a high energy density, quick charging and discharging characteristics, light weight and small volume etc.? This is inseparable from the characteristics of the polyacetylene film. The polyacetylene film synthesized by chemical methods is actually not a dense film. Under the electron microscope, we can see that it is formed by a network of filaments of 200Å long. There are many empty spaces inbetween. Therefore, it has a very large surface area. A polyacetylene film 0.1 mm thick and having an area of 1 square centimeter has an effective surface of about 2.5×10^3 square centimeters while the weight is only 3 mg. Such a large surface area and such a light weight have made polyacetylene an ideal electrode material.

In actual use, polyacetylene can be used as the anode and the cathode material at the same time. When using an organic solvent such as CH_2Cl_2 or carbonic propenyl ester as the solvent and a quaternary ammonium salt as the electrolytic medium, the following cathode reaction occurs:



The polyacetylene on the cathode reduces:



During electric discharge, the above electrode reactions reverse and electrical energy is produced. Such a battery has a bright future for development. It may possibly be used in the automobile industry.

Because we can obtain p-type and n-type materials after impregnating polyacetylene by I_2 , Br_2 , AsF_5 , AgClO_4 , naphthalene sodium and many such oxidizers or reducing agents, and because the absorption band of polyacetylene is within the visible light wavelengths, therefore, there is a future for developing the use of polyacetylene to manufacture photogenic voltage batteries to convert solar energy into electrical energy. At present, people are

already studying combinations of inorganic semiconducting materials and polyacetylene to make solar energy cells, such as the battery composed of p-type polyacetylene and ZnS which has an open circuit voltage of 0.8V, and the battery composed of the p-type polyacetylene and the n-type silicon chip which has a voltage of 0.395V and an efficiency of 75 percent.

It has only been 4 to 5 years since the discovery that impregnated polyacetylene can become a semiconductor and a conductor. Work in this regard is very active.

Besides polyacetylene, many other polymers such as polybenzene, polybenzene acetylene, polybenzene sulfur ether which can also become semiconductors and conductors after impregnation have been discovered. It is expected that in the not-to-distant future, high polymer materials will realize even greater breakthroughs in the development of new energy resources.

9296

CSO: 4013/148

APPLIED SCIENCES

BRIEFS

UNIVERSAL TIME SYSTEM--The universal time system established by China through its own scientific research efforts has maintained an advanced world level for years. It won second prize in the state natural science awards at the National Scientific and Technological Awards Meeting held in Beijing on 23 October. This system was mainly the result of research efforts by Shanghai Astronomical Observatory, with the cooperation of the Purple Mountain Observatory, the Beijing Observatory, the Wuchang Time Station of the Chinese Academy of Sciences, and the Yunnan Observatory. The precision of measuring time has been constantly increasing, with the long-period constancy reaching 1.3 milliseconds and the system's internal precision reaching 1 millisecond in recent years. [Shanghai City Service in Mandarin 1130 GMT 23 Oct 82 OW]

CSO: 4008/21

Civil Engineering

AUTHOR: LIU Bingren [0491 4426 0088]
LI Shoushan [2621 1343 6365]
WAN Shanshan [8001 3790 3790]
GU Rongkun [7357 2837 0981]

ORG: All of Department of Transportation, Shandong Province

TITLE: "Design and Construction of Huanghe Bridge in Jinan"

SOURCE: Beijing TUMU GONGCHENG XUEBAO [CHINA CIVIL ENGINEERING JOURNAL] in Chinese
No 3, Sep 82 pp 1-9

ABSTRACT: The highway bridge across Huanghe in Jinan measures a total of 2023.4 m in length, with the main bridge consisted of 5 spans of 40 + 94 + 220 + 94 + 40. The middle span crosses the major channel of the Yellow River in a cable-stayed prestressed concrete girder, measuring as long as 220 m. On both ends, the approaches are composed of 30 m spans to measure a total of 1535.4 m. The bridge is 19.5 m in width, with a net vehicle runway of 15 m. The earthquake resistance is provided to 7 magnitude. The construction of the bridge began in Dec 78; assembly of the structure was preliminarily completed in Dec 81. After load testing, the bridge was officially open for traffic on 14 Jul 82. The total investment was 36.10 million yuan. The quantity of materials used and the economic indices are given in a table. The construction control measures and the result are stated. The economic benefit of optimal design of the closely spaced stay-cables is considered not obvious. Future studies are awaited with respect to simplification of design computation, the effect of creep, and the problem of corrosion prevention of the cables.

AUTHOR: ZHANG Guoxia [1728 0948 7209]
CHENG Jida [4453 1323 6671]
SU Liren [5685 4539 0088]
ZHANG Kexu [1728 0344 4872]

ORG: ZHANG of Beijing Municipal Survey Department; CHENG of Beijing College of Construction Engineering; SU of Beijing Municipal Academy of Construction Designing; ZHANG of Research Institute of Engineering Mechanics, Chinese Academy of Sciences

TITLE: "Earthquake Response Analysis of the Foundation and Superstructure of Beijing Railway Station High-Rise Waiting Room"

SOURCE: Beijing TUMU GONGCHENG XUEBAO [CHINA CIVIL ENGINEERING JOURNAL] in Chinese
No 3, Sep 82 pp 64-71

ABSTRACT: The foundation of the high-rise waiting room of the Beijing Railway Station is partially on the abandoned river channel, consisting of silt type soft clay. During the construction period, due to excessive settling, the silicate consolidation process was applied. After the project completion, settlement continued to increase, however. Following the Xingtai Earthquake of 1966, a study on the necessity of a thorough reinforcement of the entire foundation was carried out, along with an analysis of earthquake response of the foundation, the superstructure, the clay, and their interaction. Based upon the result of computation and analysis, a decision against reinforcement was reached. The finite-element method used in the analysis and the conclusion are introduced in the paper.

6248

CSO: 4009/26

Engineering

AUTHOR: YAO Tianshun [1202 1131 7311]
WANG Baoku [3769 1405 1655]

ORG: Both of the Software Engineering Teaching and Research Group

TITLE: "The Principle of Radicals Recomposing for Chinese Characters and Its Process Program"

SOURCE: Shenyang DONGBEI GONGXUEYUAN [JOURNAL OF NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 3, Sep 82 pp 55-65

TEXT OF ENGLISH ABSTRACT: Chinese characters originate from ancient pictographs. Almost all Chinese characters can be broken down into two or more radicals (components), as viewed from the pattern structure of a character, but a few are of a single radical only. For the purpose of inputting Chinese characters into a computer, a number of research works on character recognition involving the choice and recomposing sequence have been done over the years. An existing problem is that a total of so many radicals (i.e., up to 616) is difficult to learn and operate on a corresponding keyboard. This paper is written as an attempt to establish a recomposing principle for Chinese characters and to offer a processing program in order that an untrained person may apply it. Based on a thorough analysis of the popular "Xinhua" dictionary which includes about 9,000 often-used characters, the paper puts forward a new Chinese character system in which each character is classified as one of five kinds and so the

[Continuation of DONGBEI GONGXUEYUAN No 3, Sep 82 pp 55-65]

total number of radicals is reduced to fewer than 160. Each of the characters in this system can be represented by 1 to 12 radicals but, in general, 7 fundamental radicals are sufficient to recognize most characters. Thus, an all-purpose Chinese information processing program available for use is offered. Suppose the key space consists of integral values in the interval (a,d) and is divided into j subintervals of a length L . The frequencies and cumulative frequencies are calculated and, transformed by a piecewise linear function, are well-distributed in the address space. A method is also given to resolve the problem of collision. The authors wish to reduce the radicals to 100 keys on a keyboard in the near future.

AUTHOR: ZHANG Xiuzhen [1728 4423 3791]

ORG: Northeast Institute of Technology

TITLE: "All-China Planetary Gear Drive Symposium Held at Northeast Institute of Technology"

SOURCE: Shenyang DONGBEI GONGXUEYUAN [JOURNAL OF NORTHEAST INSTITUTE OF TECHNOLOGY] in Chinese No 3, Sep 82 p 66

ABSTRACT: The All-China Planetary Gear Drive Symposium was held at Northeast Institute of Technology from 17 to 21 August 1982. The symposium was cohosted by the Xi'an Heavy Machinery Research Institute. Seventy-nine specialists, professors, engineers, etc., from 49 institutes throughout the country attended, and 63 papers were presented. Among these, Li Huamin [2621 5478 2404] of the Harbin Institute of Technology reported on the International Gear Convention held in Tokyo in 1981. Engineer Chen Zixiu [7115 5261 0208] of the Xi'an Heavy Machinery Research Institute and Assistant Professor Zhang Shaoming [1728 1421 0682] of the Xi'an Highway College reported on the planetary gear situation in China and abroad, and made suggestions for improvements. The delegates engaged in vigorous discussions on how to promote work in this field in our country, and a report on that subject was approved for submission to higher authorities.

9717

CSO: 4009/23

Instrumentation

AUTHOR: YONG Yan [0737 4291]

ORG: None

TITLE: "A New Budding Technique of Photography--Neutron Photography"

SOURCE: Beijing YIQI YU WEILAI [INSTRUMENTATION AND FUTURE] in Chinese No 8, 1982
pp 6-7, 32

ABSTRACT: The development of modern science and technology has caused great changes in photographic technology also, including, for example, the emergence of x-ray photography, laser photography, sonic wave photography, etc. and the newest technique of neutron photography. This paper introduces briefly the strange properties and characteristics of neutrons, the realization of neutron photography through the use of a converter screen, and the current research in foreign countries on the use of electron image display technique in neutron photography. Applications of neutron photography in archaeology, medicine, aviation, weapons industry, nuclear science, industrial production, etc. are briefly explained. Photos are included depicting a portable neutron camera, photos of bullets taken by neutron photography and x-ray photography, and a neutron photo of a bronze statue of buddha. Finally, the paper mentions casually that research on neutron photography is being developed in China in recent years and some preliminary results have been obtained without referring to any specifics.

AUTHOR: XU Ce [1776 3261]

ORG: None

TITLE: "Double-pulse Laser Holographic Camera"

SOURCE: Beijing YIQI YU WEILAI [INSTRUMENTATION AND FUTURE] in Chinese No 8, 1982
p 16

ABSTRACT: Beijing Research Institute of Photoelectric Technology has succeeded in making the dynamic holographic camera equipment with the double-pulse ruby laser device as the light source. The equipment is mainly used for tests in mechanics, in space navigation industry, and in precision machine engineering. Through fast recording of all transitional states, such as vibration, morphological changes, stress propagation, flow field, etc., this photographic technique makes it possible to obtain mechanical parameters for the analysis of dynamic conditions. Characteristics of this photographic equipment are also very briefly compared with those of cameras using ordinary continuous laser device as the light source. This new equipment has been certified.

AUTHOR: None

ORG: None

TITLE: "The Second Congress of Representatives of China Society of Instruments and Meters Will Soon be Held"

SOURCE: Beijing YIQI YU WEILAI [INSTRUMENTATION AND FUTURE] in Chinese No 8, 1982
p 32

ABSTRACT: The second Congress of Representatives and the Annual Conference of the China Society of Instruments and Meters will be held simultaneously this year in November in Beijing. The achievements and experiences of the past 3 years since the establishment of the society through its various activities will be summarized, its second board of directors elected, and its future activity plan discussed and formulated. During the conference time, close to 100 papers will also be exchanged to review all important accomplishments in scientific research and production of instruments and meters in China and to prepare for the multi-country symposium of instrumentation and meters technology to be held in Shanghai in Apr 83. This November conference will be attended by more than 300 delegates including the old specialists and the middle-aged and young scientists and technicians of the instrumentation and meters technology in China. At present, all items of preparation work of that conference are being tensely but smoothly readied

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CSO: 4009/28

AUTHOR: XU Ce [1776 3261]

ORG: None

TITLE: "Ion Film Coating Equipment"

SOURCE: Beijing YIQI YU WEILAI [INSTRUMENTATION AND FUTURE] in Chinese No 9, 1982
p 28

ABSTRACT: The Beijing Instrument Plant has succeeded in making the DML-500A ion film coating equipment. It is a new tool combining vacuum plating and vacuum sputtering to produce a coat of either single substance film or a film of a chemical compound of high adhesion. The technique does not pollute and provides a simple treatment for parts with a coat of film having very few pores. It has extensive applications in light industry, machine industry, electronic industry, research organizations, and universities. Its major components and chief technical indices are introduced.

AUTHOR: FU Wenyao [4569 2429 6460]

ORG: None

TITLE: "Multi-function Digital Speed-measuring Instrument"

SOURCE: Beijing YIQI YU WEILAI [INSTRUMENTATION AND FUTURE] in Chinese No 9, 1982
p 28

ABSTRACT: Joint research by Tianjin Cotton Spinning and Weaving Plant No 3 and Tianjin Electronic Instrument Plant No 2 has succeeded in making the ED-101 portable type AC-DC multi-function speedometer. It has a 5-place digital display system. When it is used in combination with a special detecting device, it has the following 5 testing functions: (1) Contact type low and intermediate speed measurement of 0-4000 rotations/min; the display is divided into 0.1 rotations/min and 1 rotation/min. segments.) (2) Noncontact intermediate and high speed measurement for less than 40,000 rotations/min and a maximum of 150,000 rotations/min.) (3) Contact type surface speed measurement; (4) Digital measurement; (5) Determining relative values (rate of extension, rate of drawing, etc.) Its measurement error is not greater than ± 0.2 percent ± 1 of the read out. The instrument has been inspected by China Academy of Metrology and Tianjin Municipal Institute of Metrological Management and deemed to be qualified. After 1+ year of small-batch production and trial applications, it has received a joint certification from Tianjin Municipal Bureau of Textile Industry and Bureau of Machine Industry No 2 and will be produced in batches by Tianjin Electronic Instrument Plant No 2 mainly for tests of rotary and linear speed in textile or other industries.

6248

CSO: 4009/29

Machine Tools

AUTHOR: SUN Zongying [1327 1350 4481]

ORG: Research Institute of Machine Tools, Ministry of Machine Industry

TITLE: "Comments on the Speedy Adoption of International Standards in Machine Tool Industry"

SOURCE: Beijing JICHUANG [MACHINE TOOL] in Chinese No 9, Sep 82 pp 41-43

ABSTRACT: China was accepted as an official member of the International Standardization Organization (ISO) in Sep 78. The Chinese National Bureau of Standards asked the Research Institute of Machine Tools to take on the work of coordinating with the ISC/TC [Technical Committee] 39 (concerning machine tools.) The standards of the machine tool industry in China were adopted in the 50's from those of the USSR. Although these standards did contribute to the economic construction in China during the first 5-year plan, after the 60's they can no longer meet the needs of the four modernization construction and the international machine tool market. At present, the production standard of some machine tool products of China are behind the ISO standards, yet the products of such factories as Shanghai Heavy Machine Tool Plant, Changcheng Machine Tool Plant, Jinan Plant No 1, etc. can all match the ISO standards or better. The author; therefore, believes that it is entirely possible for China to implement the ISO standards. He suggests the adoption of following measures: (1) Translate documents of the ISO standards; (2) Serious analysis of ISO standards and use them to check domestic products; (3) Update work processes; (4) Provide needed high precision and high efficiency molds and other apparatuses; (5) Strengthen management; (6) Establish inspection centers; (6) Practice the system of higher price for higher quality; (7) Participation in international activities.

6168

CSO: 4009/18

Metallurgy

AUTHOR: XU Peirong [1776 1014 2837]
JIANG Changsheng [5592 2490 3932]
LIU Xinzong [0491 0207 0022]

ORG: XU of Nanchang Heat Treatment Plant; JIANG of Jiangxi University; LIU of Jiangxi Provincial Electric Power Repair and Manufacture Plant

TITLE: "Energy Conservation Realized Through Improving Heat Treatment Work Process"

SOURCE: Beijing JINSHU RECHULI [HEAT TREATMENT OF METALS] in Chinese No 9, 25 Sep 82 pp 39-44

ABSTRACT: Heat treatment is a work process requiring the consumption of large amount of energy. The paper suggests that measures taken in the 3 following aspects can reduce the energy consumption in the heat treatment procedure: (1) Equipment measures; including application of heat insulating materials, utilization of waste heat, application of meters, etc.; (2) Measures of materials: including selective use of fast carburizing steel, steel used for isothermal quenching, steel used for direct normalizing, etc. (3) Measures of work technique, including shortening the duration of temperature maintenance, improving the carburizing process, subthermal, isothermal quenching, residual heat quenching forging, reducing or omitting the tempering process, etc. Energy saving methods of the 3rd category are introduced in detail in the paper.

AUTHOR: LIU Guoyan [2692 0948 3508]

ORG: None

TITLE: "1982 Annual Heat Treatment Meeting of Shanghai Branch Heat Treatment Society Held"

SOURCE: Beijing JINSHU RECHULI [HEAT TREATMENT OF METALS] in Chinese No 9, 25 Sep 82 inside backcover

ABSTRACT: The annual meeting on heat treatment, sponsored jointly by the Heat Treatment Branch of Shanghai Municipal Society of Mechanical Engineering and the Heat Treatment Group of Shanghai Municipal Society of Metals, was held on 24-26 Jun. More than 50 papers were read at the meeting; they reflect new fruits in scientific research and production techniques of heat treatment in Shanghai. For example, Shanghai Research Institute of Steel and Iron succeeded in making the 100Cr2W steel for cold rollers to cause the useful life of the rollers to be several times longer. Shanghai Machine Manufacturing Work Process Center's vacuum sputtered titanium nitride can be used to plate ceramics. Shanghai Jiaotong University and Shanghai Heat Treatment Plant have succeeded in their experiment with controlled nitriding to cause the useful life of molds, worm shafts, etc. to be several times to more than 10 times longer. All papers were well received at the meeting.

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CSO: 4009/22

END